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10/736,666	12/17/2003	Andreas Fischer	015290-757	5341

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EXAMINER

MACARTHUR, SYLVIA

ART UNIT PAPER NUMBER

1763

DATE MAILED: 01/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/736,666

Applicant(s)

FISCHER ET AL.

Examiner

Sylvia R. MacArthur

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) 23 and 24 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-22 and 25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-6, 7-9, 14-16, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hubacek (US 6,475,336) in view of Masuta et al (US 6,277,008).

Hubacek teaches an electrostatically clamped edge ring assembly for plasma processing. Regarding claim 1: The assembly comprises a lower ring 15, a ceramic intermediate ring 17, the intermediate ring is adapted to be attached via the lower ring to an RF electrode, an upper ring 18 the upper ring overlying the intermediate ring, wherein the upper ring has an upper surface exposed to an interior of a plasma reaction chamber, see Fig. 1

Hubacek fails to teach a conductive lower ring.

Masuta et al teaches a two-piece retaining ring wherein the top portion is made a hard plastic (resin) and the lower portion is made of a metal, see Fig. 1B. The motivation to construct the ring of Hubacek with the lower conductive ring of Masuta is that the lower conductive portion provides more mechanical strength to the overall ring and allows for greater throughput.

Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed

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invention to incorporate the teachings of Masuta in the ring assembly of Hubacek et al.

Regarding claim 2: The assembly of Claim 1, wherein the intermediate ring is made of aluminum oxide.

Regarding claims 3 and 14: The assembly of Claim 1, wherein the intermediate ring/upper ring is made of quartz, silicon, silicon carbide or aluminum oxide, see col. 6 lines 17-28.

Regarding claims 4,5 18, and 20: The assembly of Claim 1, wherein the conductive ring is made of stainless steel according to Masuta col. 3 line 56. However, Masuta further teaches in col.4 lines 65-67 that the metal portion is not limited to stainless steel, but a metal resistant to corrosion and having a high mechanical strength or its alloy can be used.

Aluminum and its alloys are known suitable materials of construction in the field of semiconductor manufacturing. Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention to provide aluminum and its alloys as a material of construction per the specifications desired by Masuta.

Regarding claim 7: The assembly of Claim 1, wherein the conductive ring has a plurality of holes configured to bolt the conductive ring to the RF electrode, see col.4 lines 28-33 if Hubacek.

Regarding claim 8: The assembly of Claim 1, wherein the conductive ring and the intermediate ring have a plurality of holes configured to bolt the intermediate ring to the conductive ring, see col.4 lines 28-33 of Hubacek.

Regarding claim 9: The assembly of Claim 1, wherein the conductive ring has a substantially L-shaped cross-section, see Fig. 1B of Masuta and Fig. 1 of Hubacek.

Regarding claim 15: The assembly of Claim 1, wherein the upper ring has a portion

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extending under a substrate when the substrate is located on the substrate support, see Fig. 1.

Regarding claim 16: A plasma processing apparatus comprising:

a processing chamber;

a power source which energizes process gas in an interior of the processing

chamber into a plasma state for processing a substrate;

a substrate support which supports a substrate within the interior of the

processing chamber;

a conductive lower ring;

a ceramic intermediate ring, the intermediate ring overlying the lower ring,

the intermediate ring adapted to be attached via the lower ring to an RF electrode

an upper ring, the upper ring overlying the intermediate ring, wherein the

upper ring has an upper surface exposed to an interior of a plasma reaction chamber, see col. 3

line 49 and 4 line 60.

Hubacek fails to teach a conductive lower ring.

Masuta et al teaches a two-piece retaining ring wherein the top portion is made a hard plastic (resin) and the lower portion is made of a metal, see Fig. 1B. The motivation to construct the ring of Hubacek with the lower conductive ring of Masuta is that the lower conductive portion provides more mechanical strength to the overall ring and allows for greater throughput.

Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention to incorporate the teachings of Masuta in the ring assembly of Hubacek et al.

Regarding claim 19 The apparatus of Claim 16, wherein the intermediate ring is made of aluminum oxide, see col.6 lines 17-28.

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Regarding claim 20: The apparatus of Claim 16, wherein the upper ring is made from a material selected from the group consisting of quartz, silicon, silicon carbide, graphite and aluminum, see col.6 lines 17-28 .

Regarding claim 21: The apparatus of Claim 16, wherein the plasma chamber is a semiconductor plasma etching apparatus, see col.3 lines 40-48.

Regarding claim 23: A method of reducing process drifts on a plurality of substrates in a plasma processing system comprising:

positioning a substrate in a plasma processing apparatus comprising:

a processing chamber;

a power source which energizes process gas in an interior of the

processing chamber into a plasma state for processing a substrate',

a substrate support which supports a substrate within the interior of

the processing chamber, the substrate support having an upper surface; and

an edge ring assembly comprising:

a conductive lower ring;

a ceramic intermediate ring, the intermediate ring overlying

the lower ring, the intermediate ring adapted to be attached via the lower ring to the power source; and

an upper ring, the upper ring overlying the intermediate ring,

wherein the upper ring has an upper surface exposed to an interior of the processing chamber;

supplying process gas to the chamber;

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forming a plasma adjacent the upper surface of the substrate support; and sequentially processing a plurality of substrates in the plasma processing apparatus, wherein the temperature of the upper ring is substantially cooled to an initial temperature after a first substrate is removed from the substrate support and before a subsequent substrate is placed on the substrate support to reduce process drift, see cols. 3 & 4.

Regarding 24: The method of Claim 23, wherein the substrate comprises a semiconductor wafer and the processing step comprises etching the semiconductor wafer with the plasma, see col. 3 lines 40-47.

3. Claims 6 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hubacek and Masuta as applied to claims 1-6, 7-9, 14-16, 23, and 24 above, and further in view of Zuniga et al (US 6,251,215).

The teachings of Hubacek and Masuta have been discussed above.

Both Hubacek and Masuta fail to teach the assembly of Claim 1, wherein a lower surface of the upper ring is bonded to an upper surface of the intermediate ring via a thermally conductive elastomer.

Zuniga et al teaches a carrier head with a multilayer retaining ring the upper and lower portions are secured by an adhesive layer 186. Col. 6 lines 43-49 teach that the adhesive layer is a two-part slow-curing epoxy.

The motivation to use the teachings of Zuniga et al in the apparatus resulting from the teachings of Hubacek modified by Masuta is that the use of an adhesive to secure parts is a known method of adhering portions together. A thermally conductive elastomer is included in

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one of those methods/materials known in the art. Thus, it would have been obvious at the time of the claimed invention to secure the components of the ring as recited in claims 6 and 17 of the claimed invention.

4. Claims 10-13, 17, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hubacek and Masuta as applied in claims 1-6, 7-9, 14-16, 23, and 24 in view of Koai et al (US 6,159,299).

The teachings of Hubacek have been discussed above.

Hubacek and Masuta fail to teach:

Regarding claim 10: The assembly of Claim 7, further comprising a first bolt having a tapered head at one end and a screw thread at the other end, the first bolt configured to bolt the conductive ring to the RF electrode.

Regarding claim 11: The assembly of Claim 8, further comprising a second bolt having a head at one end and a screw thread at the other end, the second bolt configured to bolt the intermediate ring to the conductive ring.

Regarding claim 12: The assembly of Claim 1, further comprising a conductive washer configured to receive a bolt having a head at one end and a screw thread at the other end, wherein the conductive washer is positioned between the upper ring and the intermediate ring.

Regarding claim 13: The assembly of Claim 12, further comprising a plurality of holes in the upper ring, wherein the plurality of holes receive a cap, the cap having a vent



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hole configured to release pressure from within the edge ring assembly.

Koai et al teaches a wafer pedestal with a purge ring 280 and a three-piece edge ring 200. Koai et al teaches the top ring 240, middle ring 230, and bottom ring 220 are bolted together by three centering bolts 271, see col.6 lines 18-46.

The motivation to combine the teachings of Hubacek as modified by Masuta and Koai et al is ensure that the components of the ring are secure and not prone to damage during the process of the wafer. Thus, it would have been obvious at the time of the claimed invention to secure the components of the ring as recited in claims 10-13.

Regarding claim 22: The ring of Hubacek as modified by Masuta also fails to teach the apparatus of Claim 16, further comprising a quartz outer ring surrounding the upper ring, the intermediate ring, the lower ring and the RF electrode.

The purge ring 280 of Koai et al surrounds the components as recited by the claim, however, the ring is not made of quartz it is made of a conductive material, i.e. Al.

Nevertheless, quartz and other ceramic materials were discussed by Hubacek and is known for its advantageous chemical and physical properties in the art of semiconducting manufacturing.

Thus, it would have been obvious at the time of the claimed invention to manufacture of the purge ring of Koai of quartz as it comprises the advantageous chemical and physical properties as recited by Hubacek and Masuta.

***Conclusion***


5. Applicant's arguments with respect to claims 1-22 and 25 have been considered but are moot in view of the new ground(s) of rejection.

The prior art by Masuta was introduced to a conductive lower ring while the prior art of Zuniga et al teaches an adhesive layer use to adhere portions of a ring.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sylvia R. MacArthur whose telephone number is 571-272-1438. The examiner can normally be reached on M-F during the core hours of 9 a.m. and 3 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Sylvia R MacArthur  
Patent Examiner  
Art Unit 1763

December 27, 2005